

1. A method for receiving a DS-CDMA signal having in-phase and quadrature component waveforms each modulated by a pseudo-noise code of length M chips so that M chips, with each chip of the M chips having one or more data samples that are each comprised of one or more quantized bits, represent one information bit, said method comprising:

converting said in-phase component waveform into a first sequence of data samples;

converting said quadrature component waveform into a second sequence data samples;

selecting one or more data samples of each of the M chips and one or more quantized bits from each selected data sample from the first or second sequence of data samples to obtain a data sequence;

processing said data sequence to determine if a signal is present in the DS-CDMA signal; and if a signal is present:

collecting a predetermined number of samples from said first and second sequences of data samples; and

decoding a predetermined number of samples from said first and second sequences of data samples to recover information from the DS-CDMA signal.

2. A method as in claim 1, wherein said processing said data sequence to determine if a signal is present comprises:

5 coherently averaging said data sequence over one or more information bits to obtain an averaged data sequence of length M chips;

correlating said averaged data sequence with a pseudo-noise code sequence of length M to obtain a correlation output; and

10 comparing said correlation output with a predetermined threshold level to determine if a signal is present in the DS-CDMA signal.

3. A method as in claim 2, wherein the n^{th} element of said data sequence is denoted by $c(n)$ and wherein said coherently averaging comprises:

calculating the sums $\sum_{p=0}^{P-1} c(k + M \cdot S \cdot p)$, wherein P is the number of

averages, S is the number of samples per chip, M is the number of chips per information bit, k is the remainder portion of $n/(MS)$ and p is the integer portion of $n/(MS)$; and

20 quantizing each sum to the one or more quantized bits.

4. A method as in claim 3, wherein the number of averages, P, is equal to or less than 30.

5. A method as in claim 2, wherein said correlating said averaged data sequence with a pseudo-noise code comprises;

5 storing said averaged data sequence as a data bit pattern;

storing said pseudo-noise sequence as a pseudo-noise bit pattern;

10 performing a bit-wise "exclusive-or" operation between said data bit pattern and said pseudo-noise bit pattern; and

calculating, from the result of said "exclusive-or" operation, the number of bits that match between said data bit pattern and said pseudo-noise bit pattern.

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6. A method as in claim 5, wherein said calculating from the result of said "exclusive-or" operation the number of bits that match between said data bit pattern and said pseudo-noise bit pattern is performed by use of a lookup table.

20 7. A method as in claim 1, wherein said converting said in-phase component waveform into a first sequence of data samples and said converting said quadrature component waveform into a second sequence data samples are performed by first and second analog-to-digital converters.

25 8. A method as in claim 1, wherein said converting said in-phase component waveform into a first sequence of data samples and said converting said quadrature component waveform into a second sequence data samples are performed by a two-into-one multiplexer followed by an analog-to-digital converter.

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9. A method as in claim 1, wherein each sample of said first and second sequence of data samples has a resolution of less than or equal to 10-bits.

10. A method as in claim 1, wherein said in-phase and quadrature waveforms
5 are sampled at a rate of XR_c , wherein R_c is the chip rate in the DS-CDMA signal and X is the number of samples per chip.

11. A method as in claim 1, wherein said first and second sequences of data samples are stored continuously in a circular buffer until a signal is detected in
10 the DS-CDMA signal and a predetermined number of samples from said first and second sequences of data samples have been collected.

12. A method as in claim 1, wherein said first and second sequences of data samples are multiplexed together, packed into x8-bit words and passed to a
15 processor for decoding.

13. A method as in claim 1, wherein said processing said data sequence to determine if a signal is present in the DS-CDMA signal and said decoding a predetermined number of samples from said first and second sequences of data
20 samples to recover information from the DS-CDMA signal is performed on a digital signal processor.

14. A method as in claim 1, wherein said decoding comprises:

25 correlating said predetermined number of samples from said first and second sequences of data samples with a pseudo-noise sequence to obtain a plurality of correlation values; and

determining the information in the DS-CDMA signal from said plurality of
30 correlation values.

15. A method as in claim 1, wherein said selecting includes sub-sampling said first or second sequence data samples to a rate of one sample per chip.

16. A computer readable medium containing instructions which, when executed on a computer, carry out a process of receiving a sampled DS-CDMA signal, said process comprising:

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causing one or more data samples of each of M chips and one or more quantized bits from each selected data sample of the sampled DS-CDMA signal to be stored in a first memory as a data sequence, said data sequence being representative of an in-phase or quadrature component of the sampled DS-CDMA signal;

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retrieving said data sequence from said first memory;

processing said data sequence to determine if a signal is present in the DS-CDMA signal; and if a signal is present:

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causing a predetermined number of samples of the DS-CDMA signal to be stored in a second memory;

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retrieving said predetermined number of samples of the sampled DS-CDMA signal from said second memory; and

decoding said predetermined number of samples of the sampled DS-CDMA signal to recover information from the sampled DS-CDMA signal.

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17. A computer readable medium containing instructions as in claim 16, wherein said processing said data sequence to determine if a signal is present comprises:

5 coherently averaging said data sequence over one or more information bits to obtain an averaged data sequence of length M;

correlating said averaged data sequence with a pseudo-noise code of length M samples to obtain a correlation output; and

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comparing said correlation output with a predetermined threshold level to determine if a signal is present in the DS-CDMA signal.

18. A computer readable medium containing instructions as in claim 17, wherein the n^{th} element of said data sequence is denoted by $c(n)$ and wherein said coherently averaging comprises:

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calculating the sums $\sum_{p=0}^{P-1} c(k + M \cdot S \cdot p)$, wherein P is the number of

averages, S is the number of samples per chip, M is the number of chips per information bit, k is the remainder portion of $n/(MS)$ and p is the integer portion of $n/(MS)$; and

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quantizing each sum to the one or more quantized bits of each selected data sample.

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19. A computer readable medium containing instructions as in claim 17, wherein said correlating said averaged data sequence with a pseudo-noise code comprises;

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storing said averaged data sequence as a data bit pattern;

storing said pseudo-noise sequence as a pseudo-noise bit pattern;

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performing a bit-wise "exclusive-or" operation between said data bit pattern and said pseudo-noise bit pattern; and

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calculating, from the result of said "exclusive-or" operation, the number of bits that match between said data bit pattern and said pseudo-noise bit pattern.

20. A device for processing a sampled DS-CDMA signal, wherein the device is directed by a computer program that is embedded in at least one of:

5 (a) a memory;

(b) an application specific integrated circuit;

(c) a digital signal processor; and

10 (d) a field programmable gate array, and the computer program, when executed, carries out the process of:

15 causing a plurality of data samples of each of M chips and a plurality of quantized bits from each selected data sample of the sampled DS-CDMA signal to be stored in a first memory as a data sequence, said data sequence being representative of an in-phase or quadrature component of the sampled DS-CDMA signal;

20 retrieving said data sequence from said first memory;

processing said data sequence to determine if a signal is present in the sampled DS-CDMA signal; and if a signal is present:

25 causing a predetermined number of samples of the sampled DS-CDMA signal to be stored in a second memory;

retrieving said predetermined number of samples of the sampled DS-CDMA signal from said second memory; and

30 decoding a predetermined number of samples of the sampled DS-CDMA signal to recover information from the sampled DS-CDMA signal.

21. A device for processing a sampled DS-CDMA signal as in claim 20, wherein said sampled DS-CDMA signal has in-phase and quadrature components, said device further comprising:

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a first analog to digital converter for receiving an in-phase component of a DS-CDMA waveform and producing the in-phase component of the sampled DS-CDMA signal; and

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a second analog to digital converter for receiving a quadrature component of a DS-CDMA waveform and producing the quadrature component of the sampled DS-CDMA signal;

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22. A device for processing a sampled DS-CDMA signal as in claim 21, further comprising:

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a means for extracting a plurality of data samples of each of the M chips and a plurality of quantized bits from each selected data sample of said in-phase or quadrature component of the sampled DS-CDMA signal to produce said data stream.

23. A device for processing a sampled DS-CDMA signal as in claim 20, wherein said processing said data sequence to determine is a signal is present comprises:

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coherently averaging said data sequence over one or more information bits to obtain an averaged data sequence of length M;

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correlating said averaged data sequence with a pseudo-noise code to obtain a correlation output; and

comparing said correlation output with a predetermined threshold level to determine is signal is present in the DS-CDMA signal.

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24. A device for processing a sampled DS-CDMA signal as in claim 23, wherein the n^{th} element of said data sequence is denoted by $c(n)$ and wherein said coherently averaging comprises:

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calculating the sums $\sum_{p=0}^{P-1} c(k + M \cdot S \cdot p)$, wherein P is the number of

averages, S is the number of samples per chip, M is the number of chips per information bit, k is the remainder portion of $n/(MS)$ and p is the integer portion of $n/(MS)$; and

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quantizing each sum to the one or more quantized bits of each selected data sample.

25. A device for processing a sampled DS-CDMA signal as in claim 23, wherein the n^{th} element of said data sequence is denoted by $c(n)$, wherein said sampled DS-CDMA signal includes a training sequence and wherein said coherently averaging comprises:

calculating the sums $\sum_{p=0}^{P-1} c(k + M \cdot S \cdot p)pn(k, b(p))$, where P is the number of averages, S is the number of samples per chip, M is the number of chips per information bit, k is the remainder portion of $n/(MS)$, p is the integer portion of $n/(MS)$, $b(p)$ is the value of the p^{th} bit in the training sequence and $pn(k, b(p))$ is the value of the k^{th} chip of the pseudo-noise code for the bit $b(p)$; and

quantizing each sum to the one or more quantized bits of each selected data sample.

26. A device for processing a sampled DS-CDMA signal as in claim 23, wherein said correlating said averaged data sequence with a pseudo-noise code comprises:

storing said averaged data sequence as a data bit pattern;

storing said pseudo-noise sequence as a pseudo-noise bit pattern;

performing a bit-wise "exclusive-or" operation between said data bit pattern and said pseudo-noise bit pattern;

calculating from the result of said "exclusive-or" operation the number of bits that match between said data bit pattern and said pseudo-noise bit pattern.